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U. S. NAVAL SCHOOL OF AVIATION MEDICINE
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SUMMARY PAGE

THE PROBLEM

A detailed epidemiologic study of airsickness in early flight training.

FINDINGS

It was found that airsickness in itself does not differentiate good from poor students. Airsickness was found to be greatest during the first three flights, in the seventh flight in which spins are introducea, and the first three dual acrobatic flights when many new maneuvers are introduced. Only 0.7 per cent of all Naval flight students are dropped due to airsickness. For many of these "drops," the airsickness seems to be used as a convenient escape mechanism.

INTRODUCTION

The airsick student aviator is a perplexing problem. To the flight instructor, persistent airsickness is often looked upon as a lack of motivation; to the physiologist, the airsick student is a product of simple, well-delineated accelerative forces; to the flight surgeon and the psychiatrist, he is often that perplexing mixture of emotions and physiology called "psychosomatic." In an attempt to delineate these various factors, this study explores two main areas: 1) a detailed epidemiologic study of sirsickness in the initial flight training of aviators; 2) clinical evaluation and discussion of two groups of student aviators, consisting of those who have completed the basic training in spite of their airsickness and those who did not complete the training due to airsickness.

PROCEDURE

All student naval aviators are assigned to the Naval Air Basic Training Command for their initial flight instruction. These are, in most part, recent college graduates, but there are also a good number of men with two years of college and some ex-enlisted personnel. After a four-month didactic and physical indoctrination at the U. S. Naval School, Pre-Flight, all students are assigned to Training Squadron One for basic flight instruction.

The basic flight instruction consists of a standard syllabus of increasing degrees of flight responsibility. To increase precision on flight maneuvers the instruction is divided into two parts: an "A" Stage of twelve 1.3-hour dual flights, culminating in soloing; and a "B" Stage of ten 1.3-hour flights, where basic acrobatics are learned. These acrobatic flights are alternate dual and solo flights. Those completing these training periods go on to other Naval air stations for more advanced training.

From November, 1963, until September, 1964, all flight instructors were asked to complete an airsickness questionnaire at the conclusion of each dual flight. The instructor rated whether the student had either nausea or vomiting severe enough so that the student could not control the aircraft; all other conditions were rated as no airsickness. In this manner, 1067 students were rated; this is 60 per cent of all students who completed the basic training during the total time period of the study and 90 per cent of those completing their training in the last seven months of the study.

RESULTS AND DISCUSSION

One hundred and eighty-eight of the 1067 students surveyed had at least one episode of airsickness. This is a total incidence of 17.6 per cent, a much higher figure than that quoted in training commands where 10-11 per cent is usually cited (2,3). It is of note that, due to the severity of our criteria, the actual incidence of those experiencing some physical discomfort from motion stimuli must be much greater.

It was our initial hypothesis that the symptom of airsickness in a training command would serve as a socially acceptable focal point and crutch for the less motivated student. The common knowledge of its ubiquity would allow the student who was not intent on continuing the program, or having difficulty, to use the symptom of airsickness as a socially acceptable and ego syntonic mode of communicating these difficulties. It was felt that the delineating of the group of airsick students would provide a distinct grouping of the poorer students. This was not the case. There was no correlation of total number of incidents of airsickness in this group with ground school grades (r = .10), nor was there a significant correlation of flight grades (r = .10) with incidents of airsickness. The average ground school grade of the 188 airsick students was 51.47, while a randomly selected group of students from the same time period, without airsickness, had an average ground school grade of 52.12. The average flight grade of the airsick students was 3.00, while that of the nonairsick group was 2.99.

Figure 1 presents the total number of times each of the 188 students was airsick. The mean number of incidents was 2.4 per airsick student, with a standard deviation of 2.2. Eighty-eight per cent of the students were sick three times or less. Fifty-three per cent of the students were sick only in the pre-solo stage, while 19 per cent were sick in the precision stage only; 28 per cent were sick in both stages. Plotted on Figure 2 are the total instances of airsickness per flight for the entire basic syllabus. Superimposed upon this is a clinical estimate, on a one to four scale, of the accelerative forces (both linear and angular) which the student undergoes during each flight.

If we examine the pattern of the episodes of airsickness during the course of the basic training (Figure 2), it is evident that there are three main periods during which the majority (79 per cent) of airsickness occurs. These are the first three flights, the seventh, and the first three dual acrobatic flights. This pattern differs in part from Hemingway's (2) findings of a steadily decreasing incidence over ten basic flights (from 10 per cent to 1 per cent), which he considered a sign of adaptation. We do not question that there is a marked factor of adaptation; however, there may be several types of adaptations to the varied sensory stimuli of the airborne environment.

In reviewing the factors contributing to airsickness, three major areas have been considered: 1) vestibular, 2) visual, and 3) psychic (1). If we assume that the primary stimulus to motion sickness is vestibular, then we would expect the incidence of motion sickness to closely follow the accelerative forces, with the majority of cases occurring after the third flight (sharp banks), and the greatest incidence on the seventh flight (first spin) and during acrobatics. The data do not completely confirm this hypothesis, as 47.5 per cent of the 188 total instances of airsickness occurred on the first three flights. More conclusively, 40 per cent of these cases occurred only on the first three flights and, more particularly, on the first two flights when accelerative forces were minimal. A small group of students (9.6 per cent) who had more than two standard deviations of airsickness, showed a triphasic pattern that followed Figure 2 quite closely, the peaks occurring at the points of maximal vestibular stimulation and decreasing subsequently. This group most likely had an extremely sensitive vestibular apparatus.

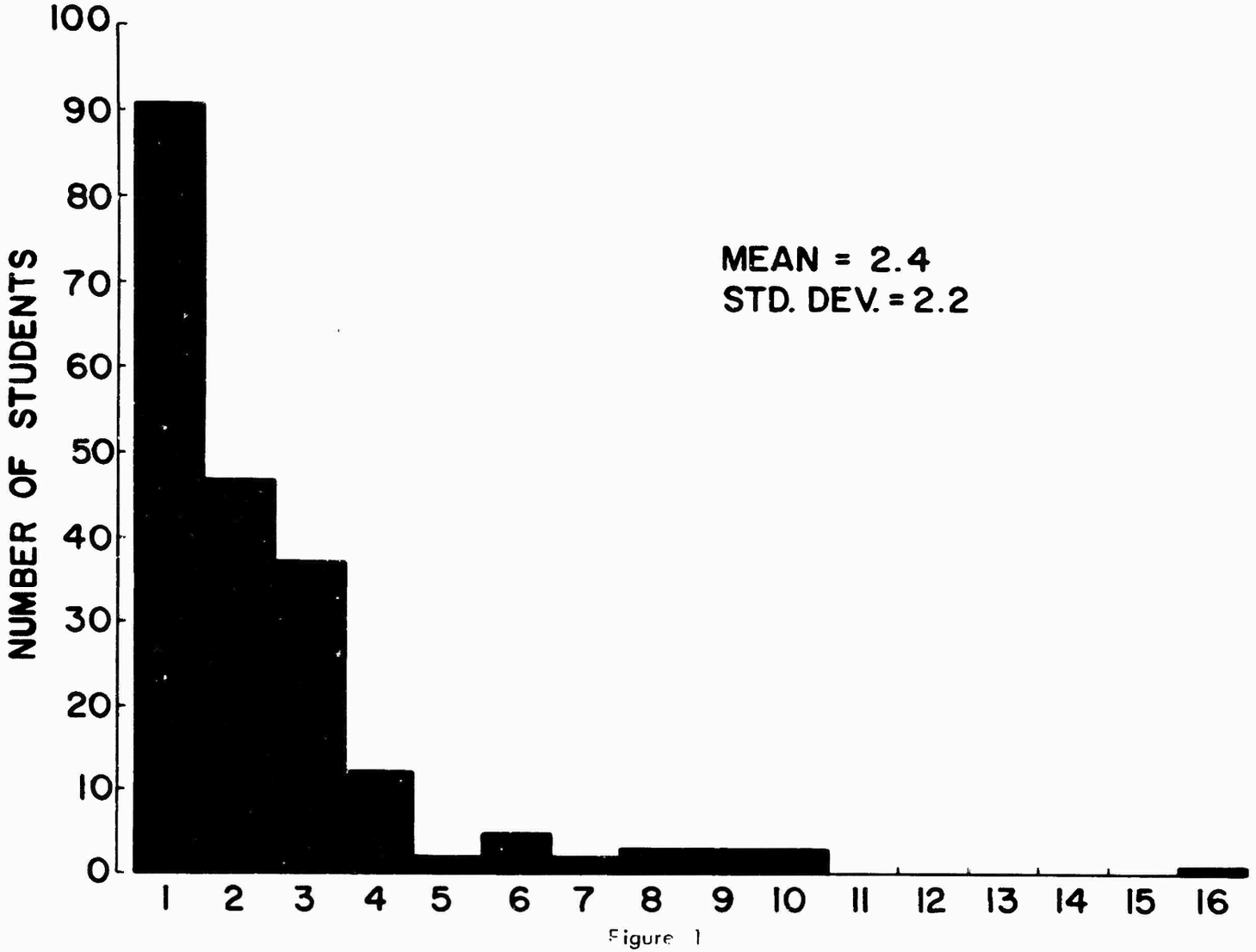

Figure 1

EPISODES OF AIRSICKNESS PER STUDENT
FOR ENTIRE TRAINING PERIOD

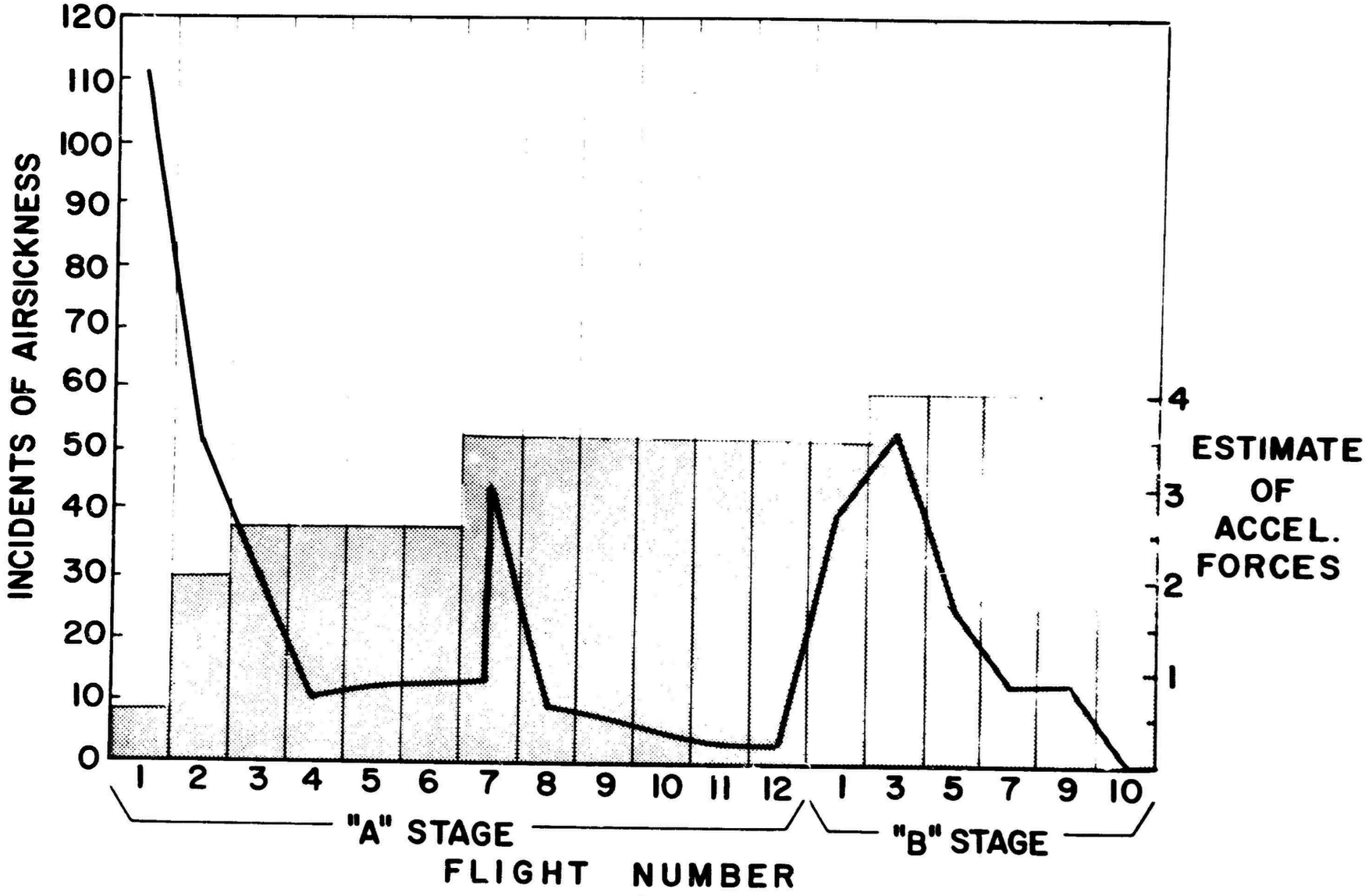

Figure 2
PATTERN OF AIRSICKNESS FOR BASIC TRAINING

When the patterns of airsickness so closely follow the physiological stimuli, it seems reasonable to attribute to them a causal relationship. However, this causal relationship is not so clearly delineated in the vast majority of incidents which occurred only once, or in the first three flights. We would have to say that particularly on the first three flights, vestibular stimulation is at a minimum and that visual stimulation, due to the novelty of the flight situation and emotional factors of anxiety and tension, is quite high. In these early flights, the anxiety is associated with the act of flight, the situation of flight. The anxiety associated with control of the aircraft or with unusual attitudes comes later in the training. It is our belief that persistent airsickness in these early stages is primarily a manifestation of anxiety. In part, both the statistical data and clinical data support this.

From the examination of two extremes, the repeatedly airsick student whose symptoms closely correlate with physiologic stimuli and the student who has few and isolated instances of airsickness uncorrelated with physiologic stimuli, we can clearly see the interplay of psychologic and physiologic factors. The student with infrequent or early airsickness is most likely using minimal stimuli to express psychologic factors of anxiety and tension. The fact that the airsickness seldom recurs is, no doubt, a testament to his mastery of this anxiety and increasing concentration on the operation of the aircraft. It is also difficult to conclude that the physiologic stimuli of the early hops provide such lasting habituation. It seems more likely that these people are minimally susceptible to the stimuli in the first place, and once they have mastered their psychologic difficulties, they cease to magnify the problem. While the psychologic factors may also be important in the student repeatedly airsick due to apparent vestibular stimulation, they are less clear. This student does show a more classic pattern of decreasing response or habituation to repeated stimuli.

During the time period of the study, there were twelve students dropped from the Flight Program for airsickness prior to completing the basic flight instruction. In the workups of these patients, all seemed to show evidences of primary motivctional difficulties. Also, both the airsickness and the motivational problems were evident quite early in the training. Eight of the students got no farther than the fifth pre-solo flight; two completed eight pre-solo flights, and two completed twelve pre-solo flights. It is of note that no students were dropped for airsickness after solo.

In order to focus more clearly on the type of student who is dropped for airsickness before the completion of the training, a clinical evaluation was made of the twelve students dropped for this reason and of eighteen students who had comparable amounts of airsickness, but who, nevertheless, completed the program. The two groups did not differ significantly in age, rank, education, marital status, and prior or present history of motion sickness.

The profile of the dropped students was quite consistent. Many of their symptoms were unrelated to physiological stimuli; e.g., they were sick on straight and level flight, prior to flying, or not sick when subjected to G forces. In the air, they seemed to exhibit poor headwork, confusion, and marked anxiety. More important was their affect; they often had a placid air, seeming to exude a feeling that things were fine, their instructor the best, and professed that they loved flying but their prime problem was the airsickness. Their main focus was on their symptoms, with marked denial of any fear of the flying experience or dangers involved. They gave the impression that they had little insight into the situation and, as such, could not extricate themselves from the situation and had to present themselves as completely helpless and at the mercy of this "incapacitating malady." Correlating with this is the fact that many of these students had strong images of their masculinity to keep intact; three of the students dropped for airsickness were Naval Academy graduates, and another student's father was one of the original "Flying Tigers." They gave the impression that any admission of fear or anxiety was completely alien to their ego and social structure. Even though the drop-on-request rate for all students at this time was 13 per cent, one got the impression that this was completely impossible for these students.

The attitude of the habituated students was quite different. Surprisingly, when asked what they felt was the cause of their symptoms, they spontaneously and usually commented that tension and anxiety were the prime factors. They cited increasing preoccupation with their symptoms and attempted numerous preventive rituals related to eating and medication in order to combat the symptoms. They did not assume a passive position about their symptoms. Part of their search very often seemed directed at their own motivation, and they described a great deal of soul searching about why they were in the Program. They also cited that the relationship with the instructor seemed important. Specifically, when things became tense between the student and instructor, their symptoms became worse.

In essence, then, we see one type of student, the airsick "drop," as a rigidly defended person unable to express anxiety or examine his own motivations and unable to admit these things to consciousness, one who externalizes all his difficulties with the symptoms of airsickness. While the habituated student seems more anxious in general, he is able to deal with these anxieties, either by seeking advice or by numerous compulsive mechanisms.

From the foregoing data, three factors are evident: 1) The problem of airsickness in an air training command is self-limited, the usual annual rate of students dropped from the program for airsickness being 0.7 per cent. During the period of this study (nine months), the rate was 0.2 per cent of the entire sample, or 2 per cent of those with any symptoms of airsickness. 2) The symptoms of airsickness may become a focus for the student in poor contact with his own anxieties and motivations and, as such, may be used as a convenient escape from an intolerable situation. 3) For the students who completed

the primary phase and who showed clear correlations between vestibular stimuli and their airsickness, the process of habituation or mastery of the situation was rapid and lasting, as airsickness was not experienced by this group in their subsequent training when they were subject to even greater accelerative forces.

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One thousand sixty-seven student Naval aviators were rated at the end of each flight during the pre-solo and basic acrobatic phase of training by the flight instructor for the presence or absence of nausea or vomiting during the flight. To be so rated, the airsickness had to be severe enough to cause inability to control the aircraft. In this manner, a profile of the patterns of airsickness was obtained on each student over the course of the primary flight training. The incidence of this type airsickness was 17.6 per cent (188 students out of 1,067). Correlations between incidents of airsickness per student and their ground school grades and flight grades were not statistically significant. There are three main periods during which the majority (79 per cent) of airsickness occurs. These are the initial three training flights, the seventh, and the first three dual acrobatic flights. These periods are closely correlated with the various and different peaks of physiologic and psychologic stresses during this phase of training and provide useful baselines for the evaluation of airsickness in student aviators.

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